AIMS65 score and shock index in predicting mortality in patients with acute upper gastrointestinal bleeding

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Abstract

Aim: The aim of the study was to investigate the effectiveness of the shock index (SI) and the AIMS65 score in predicting mortality in patients with upper gastrointestinal bleeding (UGIB) who presented to the emergency department (ED)

Material and Methods: The files of all patients with a diagnosis of UGIB over the age of 18 who visited ED during the study period were scanned from the hospital archives, taking into account the International Classification of Diseases (ICD) codes. Receiver operating characteristic (ROC) analysis, the area under the curve (AUC) and Youden Index J (YJI) was performed to analyze the performance of AIMS65 and SI in predicting in-hospital mortality.

Results: This retrospective observational study was conducted using data from 394 patients. The median age of the study population was 68 (81-54). Sensitivity, specificity, PPV, NPV, AUC and YJI values for the AIMS65 score were calculated as 100%, 64.21%, 17.60%, 100%, 0.917, 0.642, respectively (P < 0.001). The same values for the shock index were calculated as 71.43%, 88.80%, 32.8%, 97.6%, 0.807, and 0.602, respectively (P < 0.001).

Discussion: In this study, the AIMS65 score was found to be more successful than SI in predicting mortality in UGIB patients. We suggest that the AIMS65 score, which is an easily calculated score in emergency departments, should be used to predict mortality in UGIB patients.

Keywords

Gastrointestinal diseases; Gastrointestinal hemorrhage; Risk scores; Shock

Introduction

Acute upper gastrointestinal bleeding (UGIB) which originates proximal to the ligament of Treitz is a serious disease that can result in mortality [1]. This disease, which affects 48-160 out of 100,000 adults per year, can lead to poor outcomes such as recurrent UGIB (reach to 26%) and death (2%-12%) [2, 3]. Therefore, early identification of critically ill patients who will require early invasive procedures is important.

International guidelines recommend the use of risk scores at the time of the first admission to the emergency department (ED) of UGIB patients [4, 5]. However, most of these scores include endoscopic data [6-8]. These scores are useless for emergency departments, given that endoscopy is difficult to access in many emergency departments. In 2011, Saltzman JR et al. reported a simple score to assess the prognosis of patients with UGIB. This score has five variables that do not include endoscopic data: age, systolic blood pressure (SBP), altered level of consciousness, international normalized ratio (INR), and albumin. The patient will receive one point for the presence of each variable. As a result, the mortality rate is 0.3% for 0 points, 1.2% for 1 point, 5.3% for 2 points, 10.3% for 3 points, 16.5% for 4 points and 24.5% for 5 points. Those who score zero or one on the AIMS65 score are classified as low-risk in terms of in-hospital mortality risk, while those with a score of two to five are classified as high-risk. In the same study, the AIMS65 score was reported to be beneficial in reducing the length and cost of hospital stay as well as in-hospital mortality in patients with UGIB [9].

The shock index (SI) is a practical risk predictor, calculated as the ratio of heart rate (HR) to SBP. SI has been shown to increase with acute hypovolemia and left ventricular dysfunction [10]. The UK National Confidential Inquiry into Patient Outcome and Death (NCEPOD) report, published in 2015, recommended the use of the SI to identify patients with UGIB at high risk of poor outcome and the possible need for early intervention (available at: http://www.ncepod.org.uk/2015gih.html).

The aim of this study was to investigate the efficacy of SI and AIMS65 score in predicting mortality risk in patients with the diagnosis of UGIB.

Material and Methods

This retrospective observational study was carried out in the ED of a tertiary care hospital between January 1, 2020, and June 1, 2020. The institutional review board approved the analysis and issued a waiver of consent (Ethics Committee Ruling number: 2021/514/204/6, date: 22.06.2021). The files of all patients with a diagnosis of UGIB over the age of 18 who visited ED during the study period were scanned from the hospital archives, taking into account the International Classification of Diseases (ICD) codes. Patients transferred from another hospital, patients who refused to be hospitalized, patients with varicose bleeding, patients whose shock index and AIMS65 score could not be calculated, and patients whose in-hospital mortality status could not be reached were excluded from the study. Vital signs, physical examination findings, consciousness status, laboratory values, and comorbidities of each patient at admission were recorded in an Excel dataset ((Microsoft Inc., Richmond, WA). The shock index was calculated as the ratio

of heart rate (HR) to SBP. In calculating the AIMS65 score, one point was given to each of the five variables: less than 3 g/dL for serum albumin, older than 65 for age, less than 90 mmHg for SBP, higher than 1.5 for INR and altered level of consciousness. The primary outcome of the study was in-hospital mortality.

Statistical analysis was performed using IBM SPSS Statistics Version 26.0 and MedCalc Statistical Software Version 19.0.6 software. The Mann-Whitney U test was used for continuous data analysis, the Chi-square test and Fisher's Exact test were used for the analysis of categorical data. Continuous data were reported as medians and interquartile ranges (25th-75th). Categorical data were given as frequency and percentage (Tables 1 and 2). A p-value less than 0.05 was considered statistically significant.

Receiver operating characteristic (ROC) analysis was performed using the DeLong method to analyze the performance of AIMS65 and SI in predicting in-hospital mortality for UGIB patients [11]. The area under the curve (AUC), sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and Youden index J (YJI) were calculated to analyze the predictive performance of in-hospital mortality. In addition, YJI analysis was used to determine the ideal threshold values for predicting in-hospital mortality of AIMS65 and SI scores [12].

Results

After applying the exclusion criteria, this study was conducted using data from 394 patients. The number of patients in the groups was 366 for the survivors group and 28 for the non-survivors group. Among the patients included in the study, 147 were females and 247 were males. There was a statistically significant difference in favor of males between the groups in terms of genders (Table 1).

The median age of the study population was 68 (81-54) years, and the median age of the groups was calculated as 67 (53-80.25) years for the survivors group and 74 (67.5-84.75) years for the non-survivors group. A statistically significant difference was found between the groups in terms of age (Table 2).

When the effects of chronic diseases on mortality in UGIB patients were analyzed, there was a statistically significant difference in terms of mortality between the survivors and non-survivors groups for liver disease (LD), ischemic heart disease (IHD), and congestive heart failure (CHF). (Table 1).

When the effects of vital parameters on mortality were analyzed, there was a statistically significant difference between the groups for SBP, DBP, HR and spO2 (Table 2).

When the effects of symptoms on mortality were analyzed, there was a statistically significant difference between the groups for hematochezia, hematemesis, syncope and unconsciousness, while there was no statistically significant difference for melena (Table 2).

When the effectiveness of laboratory parameters in relation to mortality was analyzed, there was a significant difference between the groups for hemoglobin, urea, creatinine, INR, and albumin, while there was no significant difference between the groups for platelet count (Table 2).

The accuracy of the AIMS65 score and SI in predicting in-hospital mortality was analyzed by ROC analysis. Sensitivity, specificity, PPV, NPV, AUC and YJI values for the AIMS65 score

were calculated as 100%, 64.21%, 17.60%, 100%, 0.917, 0.642, respectively (P < 0.001) (Table 3). The same values for the shock index were calculated as 71.43%, 88.80%, 32.8%, 97.6%, 0.807, and 0.602, respectively (P < 0.001) (Table 3). The ideal threshold values for predicting in-hospital mortality in UGIB patients were calculated as "≥2" for the AIMS65 score and ">0.967" for the shock index (Table 3). When the ROC curves of the AIMS65 score and the shock index were compared, it was seen that there was a statistically significant difference between the two curves (p=0.0289).

Table 1. Gender, symptoms and comorbidity descriptives of the study population

Variables	Category	Survivors (n=366)		Non-Survivors (n=28)		Sig.
		n	percent	n	percent	p
Gender	Male	235	95.10%	12	4.90%	0.024
	Female	131	89.10%	16	10.90%	
Symptoms						
Melena	No	90	90.90%	9	9.10%	0.375
	Yes	276	93.60%	19	6.40%	
Hematochezia	No	316	94.30%	19	100.00%	0.008
	Yes	50	84.70%	9	15.30%	
Hematemesis	No	291	95.70%	13	4.30%	>0.001
	Yes	74	83.10%	15	16.90%	
Syncope	No	343	95.00%	18	5.00%	>0.001
	Yes	23	69.70%	10	30.30%	
Unconsciousness	Altered	33	68.80%	15	31.30%	>0.001
	Normal	333	96.20%	13	3.80%	
Comorbidities						
LD	No	358	93.5%	25	6.5%	0.036*
	Yes	8	72.7%	3	27.3%	
IHD	No	351	93.90%	23	6.10%	0.001
	Yes	15	75.00%	5	25.00%	
CHF	No	337	93.90%	22	6.10%	0.015
	Yes	29	82.90%	6	17.10%	
DM	No	289	93.20%	21	6.80%	0.622
	Yes	77	91.70%	7	8.30%	
HT	No	221	93.20%	16	6.80%	0.736
	Yes	145	92.40%	12	7.60%	
CRF	No	347	93.30%	25	6.70%	0.199*
	Yes	19	86.40%	3	13.60%	

*Fisher's Exact Test
LD: liver disease, IHD: ischemic heart disease, CHF: congestive heart failure, DM: diabetes mellitus, HT: hypertension, CRF: chronic renal failure, Sig: asymptotic 2-sided significance between groups

Discussion

Early diagnosis of UGIB patients with a high risk of poor prognosis will reduce morbidity and mortality. Likewise, classifying UGIB patients at a low risk may lead to the safe and early discharge of these patients, resulting in the appropriate use of healthcare resources.

In this study, the performances of SI and AIMS65 scores in predicting mortality in patients with UGIB were examined. Although the results of both prediction models were found to be satisfactory, the AIMS65 score demonstrated the best accuracy at predicting mortality with AUROC [95% CI]: 0.917 [0.885-0.942].

Patients presenting to ED with UGIB have a high risk of morbidity

Table 2. Descriptive statistics for age, vital parameters, laboratory measurements and severity scores in terms of in-hospital mortality for UGIB patients

Variables	All Patients (n=394)	Survivor (n=366)	Non-survivor (n=28)	p
Age, Median (25th-75th)				
Age	68 (81-54)	67 (53-80.25)	74 (67.5-84.75)	0.013
Vital signs and GCS, Median (25th-75th)				
SBP (mmHg)	120 (110-130)	120 (110-130)	90 (80 -108.75)	<0.001
DBP (mmHg)	64 (71-60)	65 (60-72)	50 (40-65)	<0.001
HR (bpm)	98 (90-106.25)	98 (90-105)	105.5 (96.25-110)	0.010
spO2 (%)	97 (96-98)	97 (96-98)	96 (92.50-98)	0.038
Laboratory measurements, Median (25th-75th)				
Hemoglobin (g/dl)	8.7 (7.60-10.02)	8.8 (7.8-10.1)	5.85 (4.72-7.7)	<0.001
Platelet (103/ul)	212 (153.5-265)	210 (153.5-262.25)	237 (146.75-313.5)	0.634
Urea (mg/dl)	63 (40.75-96.25)	59.50 (39-91)	104.5 (71.25-177.5)	<0.001
Kreatinin (mg/dl)	0.82 (0.65-1.04)	0.81 (0.64-1.01)	0.93 (0.72-2.02)	0.012
INR	1.18 (1.08-1.33)	1.17 (1.07-1.31)	1.51 (1.22-1.96)	<0.001
Albumin (g/L)	31 (27-35)	31 (28-35)	26 (21.13-28)	<0.001
Severity scores, Median (25th-75th)				
AIMS65 score	1 (0-2)	1 (0-2)	3 (2-4)	<0.001
Shock index	0.81 (0.75-0.89)	0.81 (0.75-0.88)	1.19 (0.86-1.37)	<0.001

p: asymptotic 2-sided significance between groups, SBP: systolic blood pressure, DBP: diastolic blood pressure, HR: heart rate, spO2: blood oxygen saturation, INR: international normalized ratio, UGIB: upper gastrointestinal bleeding

Table 3. Predictive performance of AIMS65 score and Shock index in terms of mortality for upper gastrointestinal bleeding

	Sensitivity (CI 95%)	Specificity (CI 95%)	PPV (CI 95%)	NPV (CI 95%)	AUC (CI 95%)	YJI (CI 95%)	Criterion of YJI	P*
AIMS65 score	100.00 (87.7 - 100)	64.21 (59.1 - 69.1)	17.Haz (15.7 - 19.7)	100 (& - &)	0.917 (0.885 - 0.942)	0.642	≥2	<0.001
Shock index	71.43 (47.6 - 84.1)	88.80 (85.4 - 92.1)	32.8 (25.2 - 41.4)	97.6 (95.8 - 98.6)	0.807 (0.764 -0.845)	0.602	>0.967	<0.001

*In the pairwise comparison of the ROC curves of AIMS65 score and Shock Index, the p value is calculated as 0.0289
PPV: positive predictive value, NPV: negative predictive value, AUC: area under the curve, YJI: Youden J Index, CI: confidence interval

and mortality. In the USA, more than one million patients are admitted annually due to GI bleeding [13]. Numerous risk assessment scores have been developed for these patients, but most of the scores include endoscopic data and do not seem useful for ED [14]. Saltzman et al. created the AIMS65 score with pre-endoscopic data, which was validated using 2 optimal cut-off points in a retrospective cohort of 32,504 patients. This study reported sensitivity and specificity of 0.79 and 0.61, respectively, for predicting mortality [9].

In Yaka et al.'s cohort of 254 patients, the AIMS65 score was successful in predicting mortality with an AUC of 0.81 [15]. In prospective observational study by Chang et al., AIMS65, Glasgow-Blatchford, and Rockall scores were compared, and the AIMS65 score was found to be superior to other scores with an AUC of 0.747 in estimating mortality [16]. In another study comparing AIMS65, Glasgow-Blatchford, and Rockall scores, AIMS65 was found to be the most successful scoring system with an AUC value of 0.91 in mortality prediction [17].

SI has attracted the attention of researchers since the first day it was defined and has been studied in many different diseases such as hypovolemia, sepsis, and myocardial infarction [18-20]. Similarly, there are studies on SI in predicting the prognosis of patients with UGIB. In a study examining the relationship of SI with poor prognosis in patients with UGIB, it was reported that shock index values greater than 0.7 were effective in predicting the need for intensive care, blood transfusion and endoscopic treatment [21]. In another study, it was reported that high SI values were associated with angiographic extravasation in patients with UGIB [22]. In the newly developed scoring system of Horibe et al., SI was used as a variable of the score, and they reported that this score was successful in determining the endoscopic intervention [23]. However, there are also studies reporting that SI is not a useful prediction tool. In the study by Saffouri et al., SI, Glasgow Blatchford, AIMS65, ABC, and admission Rockall scores were compared to predict the prognosis of patients with UGIB. In terms of major transfusion, endotherapy, and 30-day mortality, the SI was found to be unsuccessful compared to other scores. The authors reported that the patients in this study were younger, had less cardiovascular comorbidity, and were using less antihypertensive medication. They emphasized that these factors may explain why SI is less useful in predicting the outcome of patients with UGIB [24].

There are some limitations in our study. First, this is a single-center retrospective study conducted on a relatively small population and should be validated in a larger, multi-center cohort. In addition, it should be kept in mind that the presence of underlying comorbidities such as hypertension, diabetes mellitus, or coronary artery disease may suppress the predictive value of SI.

Conclusions

In this study, the AIMS65 score was found to be more successful than SI in predicting mortality in UGIB patients. We suggest that the AIMS65 score, which does not require endoscopic data and patients' comorbidity information and can be easily calculated in emergency departments, should be used to estimate mortality in UGIB patients.

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